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(58) Field of Search

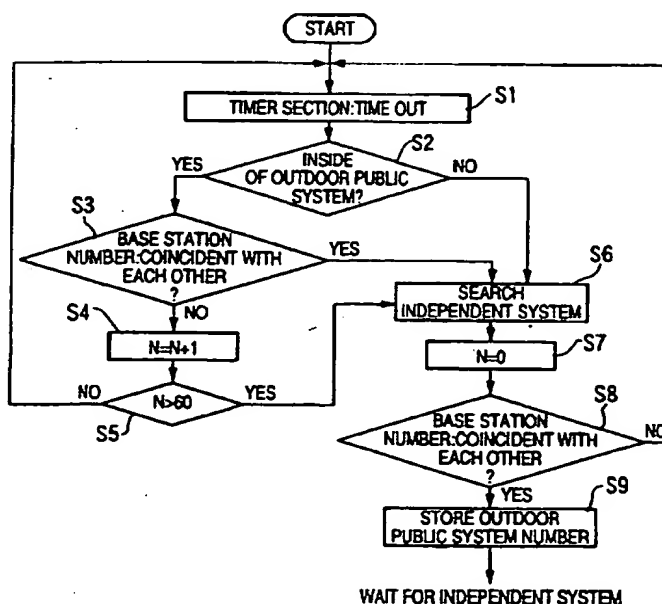
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(54) Abstract Title

Cellular/cordless telephone with power-saving search mode

(57) A mobile terminal operable in an independent cordless telephone system and in a public cellular network attempts periodically to detect a beacon signal from the cordless base station. The interval between successive attempts is shorter when the cell in which the mobile is present is one which at least partly overlaps with the coverage area of a cordless base station and longer otherwise. The mobile may cease to attempt detection at all in a non-overlapping cell. Power consumption by the mobile unit is thereby reduced.

Fig. 6



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Fig.1 PRIOR ART

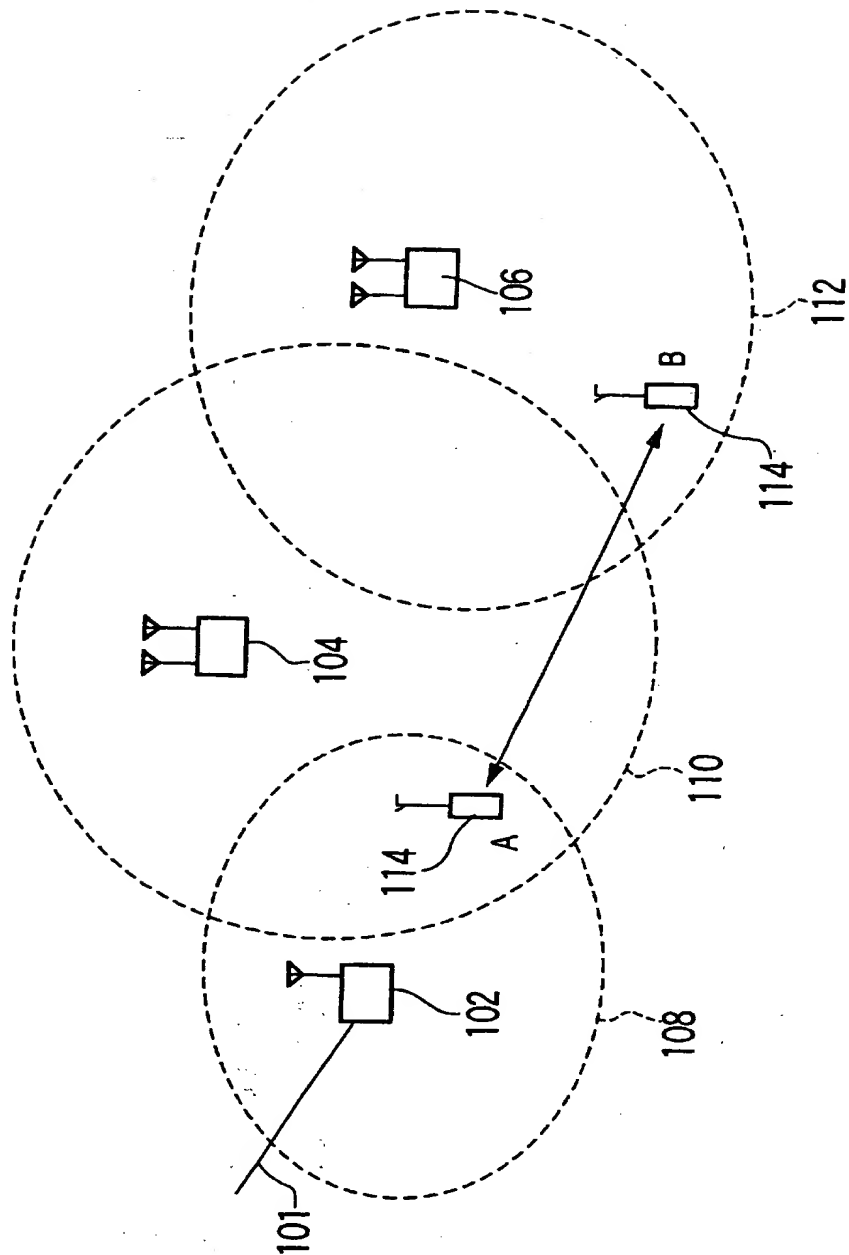


Fig. 2 A  
PRIOR  
ART

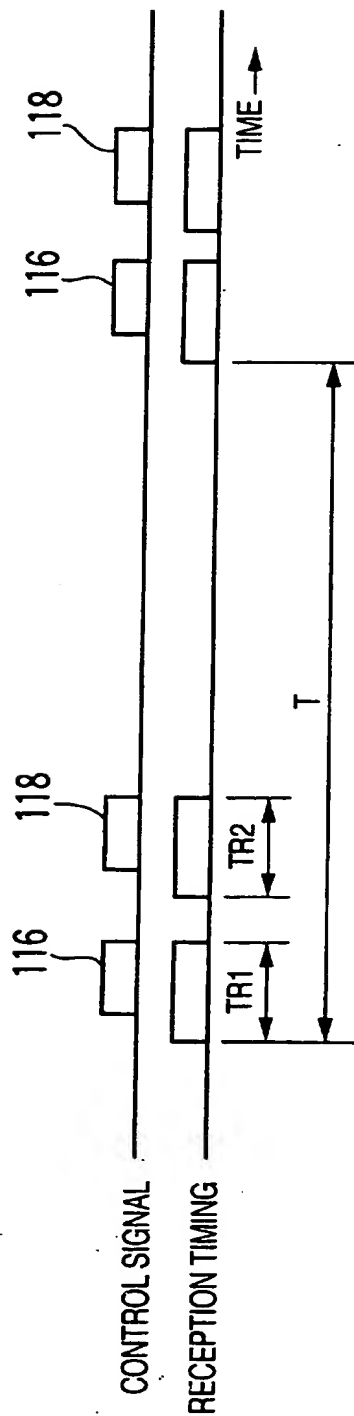


Fig. 2 B  
PRIOR  
ART

Fig. 3

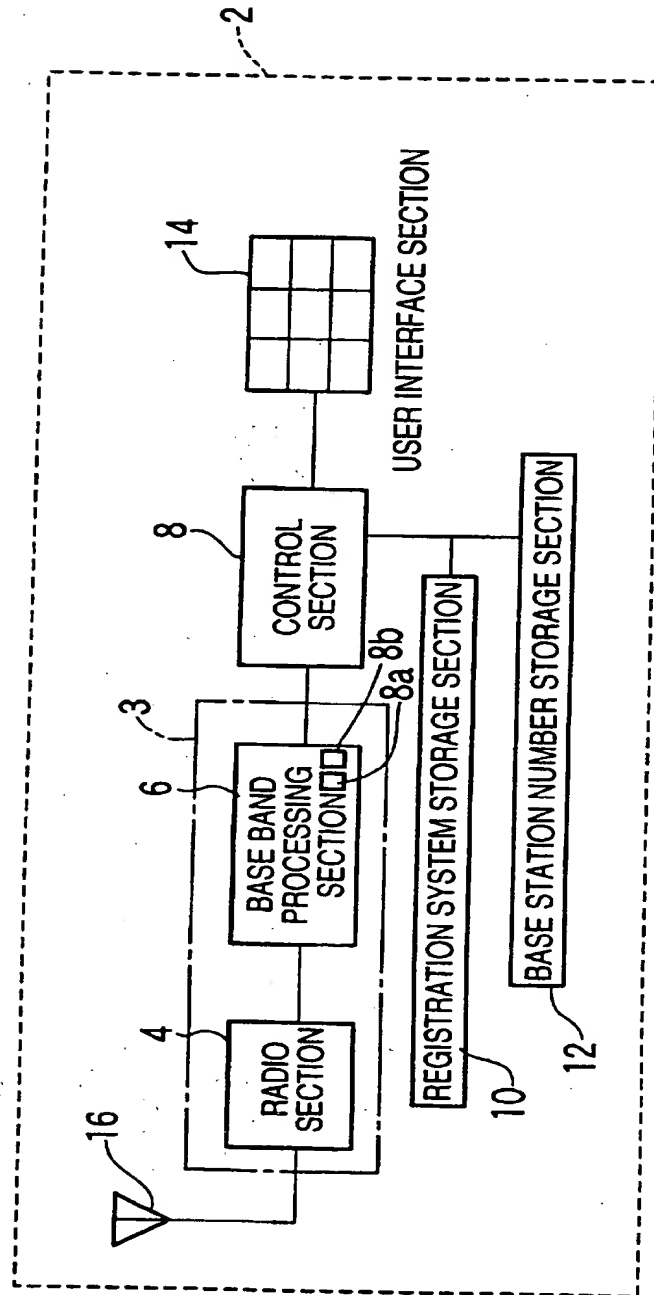


Fig. 4

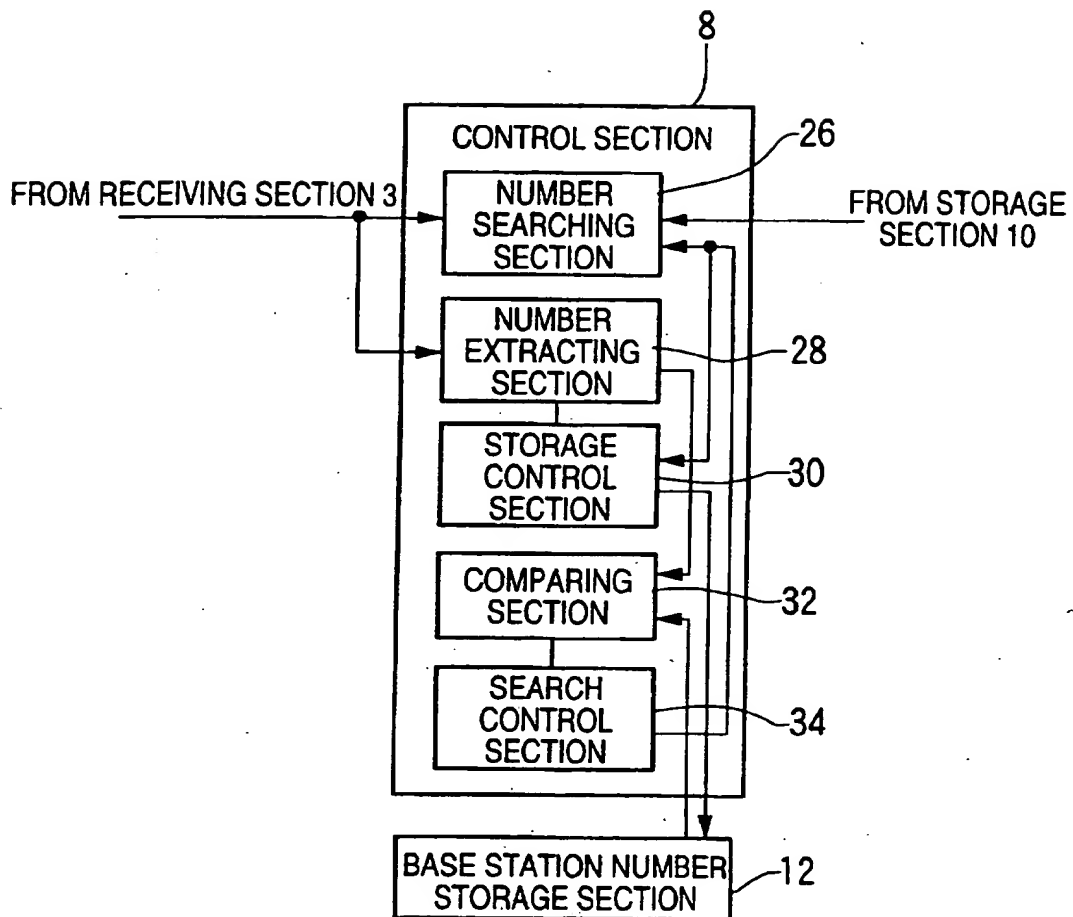




Fig. 5

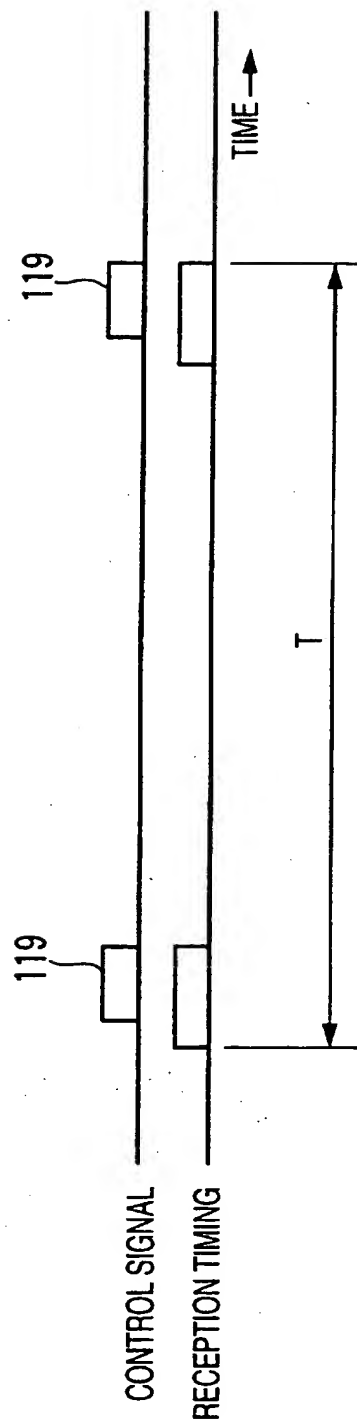


Fig. 7 A

Fig. 7 B

Fig. 6

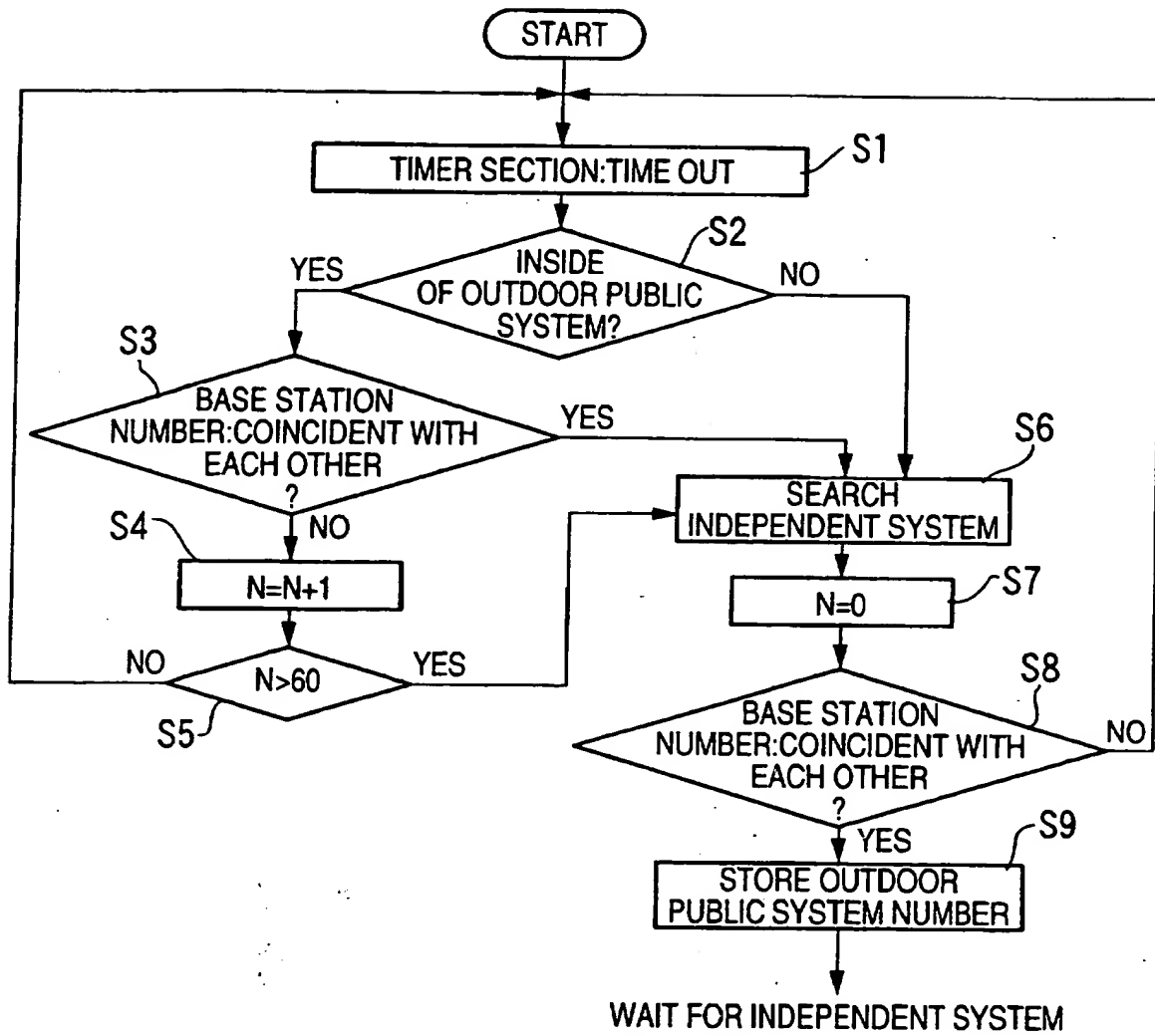
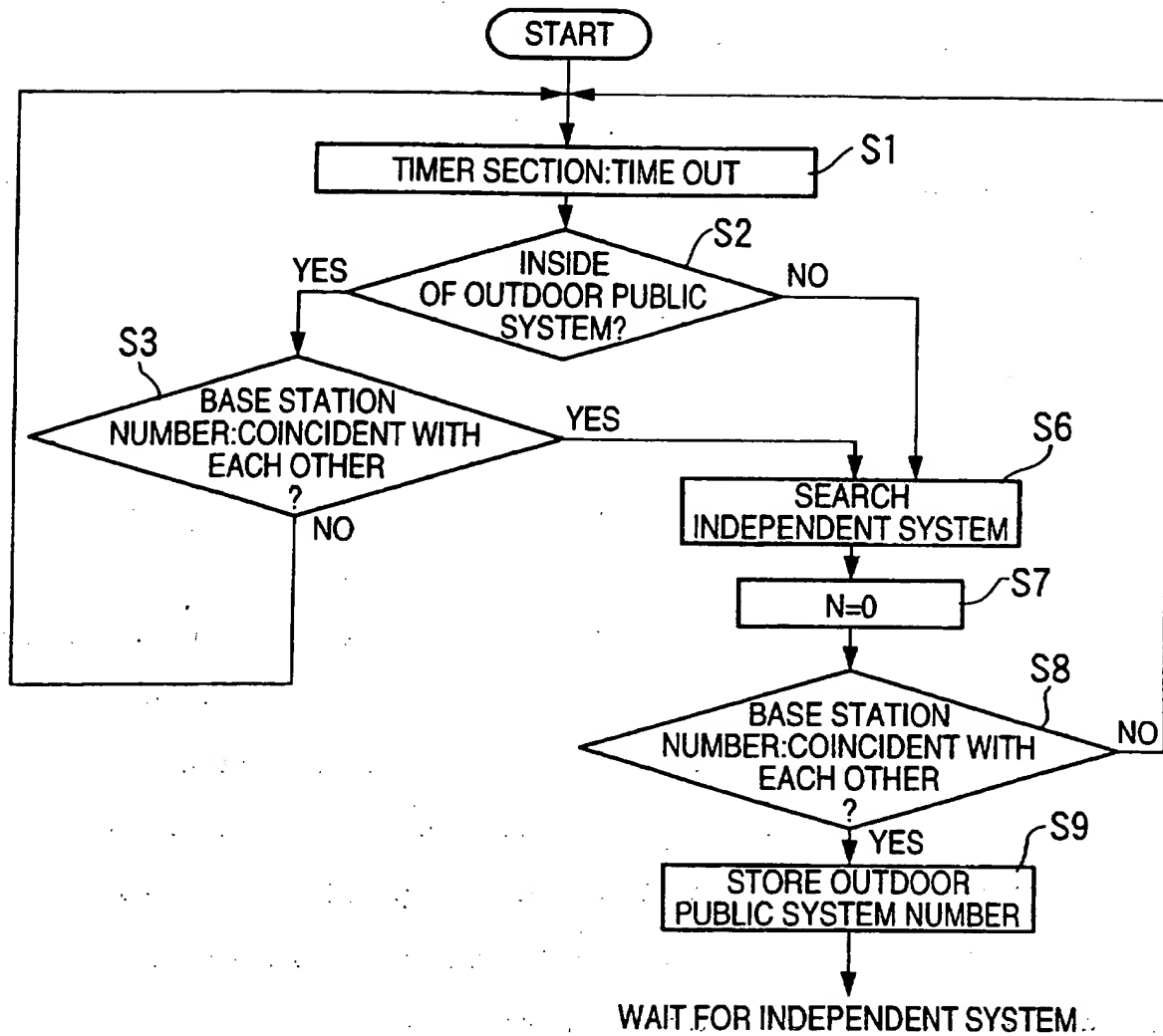


Fig. 8





## COMMUNICATION METHOD AND APPARATUS

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## Background of the Invention

1. Field of the Invention

The present invention relates to a cordless telephone that can make a call through each of an independent system base station and an outdoor public system base station, and its communication method.

2. Description of the Related Art

15 In a second generation cordless telephone system, a digital cordless telephone of the system can be registered in advance on each of an outdoor public telephone communication system and an independent (private) telephone communication system to be used as a personal station (mobile station) of both the outdoor public telephone communication system and the independent telephone communication system.

Hereafter, in this specification, the outdoor public telephone communication system is merely referred to as an outdoor public system. The independent telephone communication system is

intended to be used as a local facility, such as a home or a business building. Also, it is merely referred to as an independent system. The independent system implies a telephone communication system for the home and the business building.

Fig. 1 is a schematic configuration view showing such a second generation cordless telephone system as a whole. In the example shown in Fig. 1, two outdoor public system base stations 104, 106 are provided in the vicinity of an independent system base station 102 connected to a telephone line 101. A part of a service area (receiving region) 108 of the independent system base station 102 and a part of a service area 110 of the outdoor public system base station 104 overlap with each other. A service area 112 of the outdoor public system base station 106 does not overlap with the service area 108, and then overlaps with a part of the service area 110.

The independent system base station 102 and the outdoor public system base stations 104, 106 periodically transmit respective control signals. As shown in timing charts of Figs. 2A and 2B, usually, a cordless telephone 114 intermittently receives these control signals 116, 118 in reception periods TR1, TR2 that are alternately

repeated at in a certain period T. In addition,  
the control signal 116 is a control signal  
transmitted from the independent system base  
station 102, and the control signal 118 is a  
5 control signal transmitted from the outdoor  
public system base station 104.

The cordless telephone 114 searches the  
received control signals 116, 118 to then judge  
whether or not base station numbers of the  
10 independent system and the outdoor public system  
are included in the control signals 116, 118. A  
state in which the cordless telephone 114 carries  
out the judgment is referred to as a waiting  
state. Then, if the base station number of the  
15 independent system is included as the judged  
result, the cordless telephone 114 can make a  
communication between the cordless telephone 114  
and the independent system base station 102 and  
can make a call through the independent system  
20 base station 102. If the base station number of  
the outdoor public system is included as the  
judged result, the cordless telephone 114 can  
make a communication between it and the outdoor  
public system base station, and can also make a  
25 call through the outdoor public system base  
station.

As shown in Fig. 1, if the cordless

telephone 114 exists at a location A, the cordless telephone 114 receives at a time division the control signals from both the independent system base station 102 and the outdoor public system base station 104 to then search the base station numbers of the respective systems in the respective control signals. On the other hand, if the cordless telephone 114 exists at a location B, it can receive only the control signal from the outdoor public system base station 106, and can not receive the control signal from the independent system base station 102. Thus, the cordless telephone 114 can make only a call through the outdoor public system base station 106, since it can not search the base station number of the independent system.

By the way, if the cordless telephone 114 exists outside the service area 108, the cordless telephone 114 can not make a call through the independent system base station 102. Thus, it is possible to stop a waiting operation of receiving the control signal from the independent system base station 102 to search the base station number of the independent system base station 102. Accordingly, it is possible to reduce a consumption power in the cordless telephone 114 and suppress an exhaustion of a power supply

battery of the telephone to thereby make a callable time longer.

However, the following trouble is induced if the waiting operation to the independent system is immediately stopped, merely because the cordless telephone 114 exists outside the service area 108. This trouble is that the call in the independent system can not be made even if the cordless telephone 114 is situated inside the service area 108 when the cordless telephone 114 was situated relatively close to the service area 108 and has moved into the service area 108.

In addition, the following techniques are well known as the cordless telephone.

15       The following technique is disclosed in Japanese Laid Open Patent Application (JP-A-Heisei 7-240966). A cordless telephone has a first synchronizer synchronous with an outdoor public system and a second synchronizer  
20       synchronous with a home (independent) system, and is synchronous with the home system inside a service area for the home system, and is synchronous with the public system inside a service area for the public system. Then, it can  
25       be automatically switched by an independent/public switch. If the cordless telephone moves from the service area of one

system to the service area of the other system,  
it is automatically synchronous with the system.

The following technique is disclosed in  
Japanese Laid Open Patent Application (JP-A-  
5 Heisei 8-79829). When a power supply of a mobile  
station is turned ON, when a mobile station in  
the waiting state carries out an outside area  
detection, or when the mobile station in the  
waiting state is registered on a public base  
10 station adjacent to a home/business facility  
system, an automatic mode setting manager causes a  
signal detector from the public base station and  
a signal detector from the home/business facility  
base station to detect the signals from the  
15 public base station and the home/business  
facility base station. Then, it sets a mode for a  
home/business facility mode if there is a  
communicable home/business facility base station,  
and sets a mode for a public mode if the  
20 home/business facility base station can not make  
a communication and further there is the  
communicable public base station, and then  
establishes an automatic mode setting in which a  
priority is set for the home/business facility  
25 mode and a location registration associated  
therewith.

The following technique is disclosed in

Japanese Laid Open Patent Application (JP-A-Heisei 8-172666). Immediately after the mobile station moves inside a reception area of an identification symbol (CS-ID) of an independent  
5 radio base station (CS) that can be accessed as a cordless telephone or outside the reception area, an identification symbol (BS-ID) of a public radio base station (BS) that can be accessed as a portable telephone receiving an electric wave is  
10 stored in the mobile station as a boundary area. Then, the mobile station automatically switches (1) a cordless telephone mode of waiting an incoming signal from the CS in an area where the CS-ID can be received, (2) a portable telephone  
15 mode of waiting an incoming signal from the BS in an area where the BS-ID can be received except a boundary area, and (3) a boundary mode of waiting the incoming signals from both the BS and the CS in an area where the BS-ID of the boundary area  
20 can be received.

Moreover, the following technique is disclosed in Japanese Laid Open Patent Application (JP-A-Heisei 8-172666). The mobile station can store therein a system call symbol of  
25 an independent system that can be accessed by an intra-station and an enterpriser identification symbol of a public system and freely move in a

radio zone of the independent system and the public system and also carry out a transmission and a reception.

A control signal, such as an incoming  
5 signal to the mobile station or the like, is transmitted at a frequency different for each system from the independent system base station (CS) and a plurality of public system base stations (BS), and also intermittently  
10 transmitted at a timing different for each CS and BS.

Each system waits for the incoming signal through the intermittent reception in time to an intermittent reception timing from each CS or the  
15 plurality of BSs. Typically, the mobile station is ready for the signal reception from the mobile communication system side and always waits for the incoming signal from the CS or the plurality of BSs through the intermittent reception. If the  
20 reception of the incoming signal through the intermittent reception can not be done because of the movement outside the radio zone and the like, it waits for the incoming signal through the intermittent reception by again matching the  
25 timing with the intermittent transmission from other CS or the plurality of BSs inside the system through a continuous reception within a



certain period.

The following technique is disclosed in Japanese Laid Open Patent Application (JP-A-Heisei 9-70073). At a time of an independent mode operation, a registration of location information at a time of a public mode operation is cancelled, and information in relation to an independent radio zone is registered. In addition, at a time of the public mode operation, the registration of the information in relation to the independent radio zone is cancelled, and the location information of a radio communication terminal in relation to a public radio zone is registered. Then the database in which such predetermined information is registered or removed is searched, and the control of the reception and the transmission of an incoming call are carried out in accordance with the result.

The following technique is disclosed in Japanese Laid Open Patent Application (JP-A-Heisei 9-261755). An identification symbol of the public base station whose area reaches the independent base station is stored in a built-in memory of a micro computer. If a synchronization with any one of control channels of the public base station and the independent base station is not established, a state of alternately receiving

the control channels of the public base station and the independent base station is set. If the reception of the control channel of the public base station establishes the synchronization with the control channel thereof, it is judged whether or not an identification symbol included in the control channel coincides with the identification symbol stored in the built-in memory. If it coincides as the judged result, namely, if it is located in the vicinity of the independent base station, it proceeds to a state of receiving the control channel of the independent base station. On the other hand, if it does not coincide as the judged result, namely, if it is located away from the independent base station, the location registration is carried out, and it proceeds to a waiting state of the control channel of the public base station.

#### Summary of the Invention

The present invention has been made to

solve the above-described problems of the conventional communication method of a cordless telephone and the cordless telephone. An object of the present invention is to provide a

5 communication method of a cordless telephone that can always make a call as necessary and suppress an unnecessary waiting operation to reduce a consumption power, and a cordless telephone for use in the method.

10 In order to achieve an aspect of the present invention, a radio communication method includes (a) providing a mobile station which can make a call through each of an independent system base station and an outdoor public system base  
15 station, and (b) changing a period when a waiting operation to the independent system base station is performed, based on a distance between the mobile station and the independent system base station.

20 In this case, the (b) step includes stopping the waiting operation to the independent system base station, instead of the changing the period.

Also in this case, when a value of the  
25 distance is larger than a predetermined value, the (b) step includes making the period longer than that of a case that the distance value is

not larger than the predetermined value.

Further in this case, the (b) step includes detecting the distance based on a receiving signal received by the mobile station from the outdoor public system base station adjacent to the independent system base station.

In this case, the (a) step includes providing a plurality of the outdoor public system base stations, and the outdoor public system base station adjacent to the independent system base station is one of the plurality of outdoor public system base stations which is positioned the closest to the independent system base station.

Also in this case, the (b) step includes changing the period, depending on whether the mobile station belongs to a specific region, wherein the specific region includes at least a part of a receiving region of the independent system base station and is wider than the at least a part of the receiving region of the independent system base station.

Further in this case, the specific region includes the receiving region of the independent system base station and a receiving region of the outdoor public system base station adjacent to the independent system base station.

In this case, the (b) step includes (c) judging in a first period as the period whether or not the mobile station belongs to a receiving region of the independent system base station as  
5 an independent receiving region, based on a receiving signal received by the mobile station, (d) detecting, as an unspecific outdoor public system base station, the outdoor public system base station, to whose receiving region the  
10 mobile station belongs, regardless of whether the mobile station belongs to the independent receiving region or not, (e) detecting, as a specific outdoor public system base station, the outdoor public system base station, to whose  
15 receiving region the mobile station belongs, when it is judged as a result of the (c) step that the mobile station belongs to the independent receiving region, (f) comparing the detected unspecific outdoor public system base station  
20 with the detected specific outdoor public system base station, (g) detecting the distance based on a result of the (f) step, (h) judging whether or not the detected distance is larger than a predetermined value, and (i) performing the (c)  
25 step in a second period longer than the first period when it is judged as the result of the (c) step that the mobile station does not belong to

the independent receiving region and it is judged as a judgment result of the (h) step that the detected distance is larger than the predetermined value.

5           Also in this case, the (c) step includes judging that the mobile station belongs to the independent receiving region, when the receiving signal received by the mobile station has an independent system base station identification  
10 signal indicating that the receiving signal is transmitted from the independent system base station, the (d) step includes detecting the unspecific outdoor public system base station, based on an outdoor public system base station  
15 identification signal included in the receiving signal, indicating that the receiving signal is transmitted from the outdoor public system base station, and the (e) step includes detecting the specific outdoor public system base station, when  
20 it is judged that a first receiving signal corresponding to the receiving signal has the independent system base station identification signal as a result of the (c) step, based on the outdoor public system base station identification  
25 signal included in a second receiving signal received by the mobile station immediately after the first receiving signal.

Further in this case, the (e) step includes detecting the specific outdoor public system base station, based on the outdoor public system base station identification signal included in the receiving signal received next to the independent system base station identification signal by the mobile station.

In this case, the (e) step includes detecting the specific outdoor public system base station, based on the outdoor public system base station identification signal included in the receiving signal received in a same period as the period when the independent system base station identification signal is received.

Also in this case, the (f) step is performed each time the unspecific outdoor public system base station is detected as a result of the (d) step.

Further in this case, the radio communication method further includes (j) performing the (c) step in the first period, when it is judged as the result of the (c) step that the mobile station belongs to the independent receiving region or when it is judged as the result of the (h) step that the detected distance is not larger than the predetermined value, and when the (c) step is performed in the second

period.

In this case, the (b) step includes (c) judging in a first period as the period whether or not the mobile station belongs to a receiving region of the independent system base station as  
5 an independent receiving region, based on a receiving signal received by the mobile station, (d) detecting, as an unspecific outdoor public system base station, the outdoor public system  
10 base station, to whose receiving region the mobile station belongs, regardless of whether the mobile station belongs to the independent receiving region or not, (e) detecting, as a specific outdoor public system base station, the  
15 outdoor public system base station, to whose receiving region the mobile station belongs, when it is judged as a result of the (c) step that the mobile station belongs to the independent receiving region, (f) comparing the detected  
20 unspecific outdoor public system base station with the detected specific outdoor public system base station, and (k) performing the (c) step in a second period longer than the first period when  
it is judged as the result of the (c) step that  
25 the mobile station does not belong to the independent receiving region and it is judged as a result of the (f) step that the unspecific



outdoor public system base station and the specific outdoor public system base station do not coincide with each other.

Also in this case, the (b) step includes  
5 performing the (b) step for each the period.

In order to achieve another aspect of the present invention, a radio communication apparatus that can make a call through each of an independent system base station and an outdoor  
10 public system base station includes a timer for counting a time period during which a waiting operation to the independent system base station is performed, and a control section for  
controlling the timer such that the time period  
15 is changed in accordance with a distance between the radio communication apparatus and the independent system base station.

In this case, the control section controls the timer such that the waiting operation is  
20 stopped, instead of controlling the timer such that the time period is changed.

Also in this case, when the distance is larger than a predetermined value, the control section controls the timer to make the time  
25 period longer than that of a case in which the distance is not larger than the predetermined value.

Further in this case, the control section detects the distance based on a receiving signal received by the radio communication apparatus from the outdoor public system base station adjacent to the independent system base station.

In this case, the control section changes the time period, depending on whether the radio communication apparatus belongs to a specific region, wherein the specific region includes at least a part of a receiving region of the independent system base station and is wider than the at least a part of the receiving region of the independent system base station.

Also in this case, the control section includes a judging means for judging as a specific judgment in a first period whether or not the radio communication apparatus belongs to a receiving region of the independent system base station as an independent receiving region, based on a receiving signal received by the radio communication apparatus, a first detecting means for detecting, as an unspecific outdoor public system base station, the outdoor public system base station, to whose receiving region the radio communication apparatus belongs, regardless of a result of the specific judgement, a second detecting means for detecting, as a specific

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outdoor public system base station, the outdoor public system base station, to whose receiving region the radio communication apparatus belongs, when the judging means judged that the radio

5 communication apparatus belongs to the independent receiving region as the specific judgement, a comparing means for comparing the detected unspecific outdoor public system base station with the detected specific outdoor public

10 system base station, a detecting means for detecting the distance based on a comparison result by the comparing means, a determining means for determining whether or not the detected distance is larger than a predetermined value,

15 and a control means for controlling the judging means such that the judging means performs the specific judgment in a second period longer than the first period when the judging means judged that the radio communication apparatus does not

20 belong to the independent receiving region and the determining means determined that the detected distance is larger than the predetermined value.

Further in this case, the judging means

25 judges that the radio communication apparatus belongs to the independent receiving region, when the receiving signal received by the radio

communication apparatus has an independent system base station identification signal indicating that the receiving signal is transmitted from the independent system base station, the first  
5 detecting means detects the unspecific outdoor public system base station, based on an outdoor public system base station identification signal included in the receiving signal, indicating that the receiving signal is transmitted from the  
10 outdoor public system base station, and the second detecting means detects the specific outdoor public system base station when the judging means judged that a first receiving signal corresponding to the receiving signal has  
15 the independent system base station identification signal, based on the outdoor public system base station identification signal included in a second receiving signal received by the radio communication apparatus immediately  
20 after the first receiving signal.

In this case, the control section includes a judging means for judging as a specific judgment in a first period whether or not the radio communication apparatus belongs to a  
25 receiving region of the independent system base station as an independent receiving region, based on a receiving signal received by the radio

communication apparatus, a first detecting means  
for detecting, as an unspecific outdoor public  
system base station, the outdoor public system  
base station of which the radio communication  
5 apparatus belongs to a receiving region,  
regardless of a result of the specific judgment,  
a second detecting means for detecting, as a  
specific outdoor public system base station, the  
outdoor public system base station of which the  
10 radio communication apparatus belongs to a  
receiving region, when the judging means judged  
that the radio communication apparatus belongs to  
the independent receiving region as the specific  
judgment, a comparing means for comparing the  
15 detected unspecific outdoor public system base  
station with the detected specific outdoor public  
system base station to determine that the  
detected unspecific outdoor public system base  
station and the detected specific outdoor public  
20 system base station coincide with each other or  
not, and a control means for controlling the  
judging means such that the judging means  
performs the specific judgment in a second period  
longer than the first period when the judging  
25 means judged that the radio communication  
apparatus does not belong to the independent  
receiving region and the comparing means

determined that the unspecific outdoor public system base station and the specific outdoor public system base station do not coincide with each other.

5           In order to achieve still another aspect of the present invention, a radio communication system includes an independent system base station, an outdoor public system base station, and a radio communication apparatus that can make  
10 a call through each of the independent system base station and the outdoor public system base station, wherein the radio communication apparatus includes a timer for counting a time period during which a waiting operation to the  
15 independent system base station is performed, and a control section for controlling the timer such that the time period is changed, in accordance with a distance between the radio communication apparatus and the independent system base station.

20           In order to achieve yet still another aspect of the present invention, a computer readable recording medium for a recording a program for a process includes (c) judging as a specific judgment in a first period whether or  
25 not a mobile station belongs to a receiving region of an independent system base station as an independent receiving region, based on a

receiving signal received by the mobile station,  
(d) detecting, as an unspecific outdoor public  
system base station, an outdoor public system  
base station, to whose receiving region the  
5 mobile station belongs, regardless of a result of  
the specific judgment, (e) detecting, as a  
specific outdoor public system base station, the  
outdoor public system base station, to whose  
receiving region the mobile station belongs, when  
10 it is judged as the result of the specific  
judgment that the mobile station belongs to the  
independent receiving region, (f) comparing the  
detected unspecific outdoor public system base  
station with the detected specific outdoor public  
15 system base station, and (j) performing the (c)  
step in a second period longer than the first  
period when it is judged as the result of the  
specific judgment that the mobile station does  
not belong to the independent receiving region  
20 and it is judged as a result of the (f) step that  
the unspecific outdoor public system base station  
and the specific outdoor public system base  
station do not coincide with each other.

In another aspect the present invention provides a radio communication method, comprising:

(a) providing a mobile terminal apparatus which is adapted to communicate with an independent system base station and an outdoor public system base station; and

(b) determining the time intervals at which an attempt to detect a signal from said independent system base station should be made in dependence upon the location of said mobile terminal apparatus relative to the base stations.

In another aspect the present invention provides a mobile terminal apparatus which is adapted to communicate with an independent system base station and an outdoor public system base station by radio communication, comprising means for determining the time intervals at which an attempt to detect a signal from said independent system base station should be made in dependence upon the location of said mobile terminal apparatus relative to the base stations.

In another aspect the present invention provides a radio communication system comprising

the above mobile terminal apparatus;

an independent system base station; and

an outdoor public system base station.

In another aspect the present invention provides a computer readable recording medium having a program recorded thereon for a process comprising:

(c) judging as a specific judgement in a first interval whether or not a mobile terminal apparatus is situated within the



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receiving region of an independent system base station as an independent receiving region, based on a receiving signal received by said mobile terminal apparatus;

(d) detecting, as an unspecific outdoor public system base station, an outdoor public system base station, within whose receiving region said mobile terminal apparatus is situated, regardless of a result of said specific judgement;

(e) detecting, as a specific outdoor public system base station, said outdoor public system base station, within whose receiving region said mobile terminal apparatus is situated; when it is judged as said result of said specific judgement that said mobile terminal apparatus is situated within said independent receiving region;

(f) comparing said detected unspecific outdoor public system base station with said detected specific outdoor public system base station; and

(j) performing said (c) step in a second interval longer than said first interval when it is judged as said result of said specific judgement that said mobile terminal apparatus is not situated within said independent receiving region and it is judged as a result of said (f) step that said unspecific outdoor public system base station and said specific outdoor public system base station do not coincide with each other.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Preferred features of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which like reference numbers indicate like features and wherein:

Fig. 1 is a schematic configuration view  
5 showing a second generation cordless telephone  
system as a whole;

Fig. 2A is a timing chart showing a  
transmission timing of a control signal when a  
cordless telephone waits for the control signals  
10 from both an independent system base station and  
an outdoor public system base station;

Fig. 2B is a timing chart showing a  
reception timing of a control signal when a  
cordless telephone waits for the control signals  
15 from both the independent system base station and  
the outdoor public system base station;

Fig. 3 is a block diagram showing a  
cordless telephone of an embodiment of the  
present invention;

20 Fig. 4 is a block diagram showing a control  
section of an embodiment of a cordless telephone  
according to the present invention;

Fig. 5 is a format view showing a control  
signal transmitted from a base station;

25 Fig. 6 is a flowchart showing operations of  
the cordless telephone in Fig. 3;

Fig. 7A is a timing chart showing a

transmission timing of a control signal when a cordless telephone in Fig. 3 waits for the control signal from an outdoor public system base station;

5           Fig. 7B is a timing chart showing a reception timing of a control signal when the cordless telephone in Fig. 3 waits for the control signal from the outdoor public system base station; and

10           Fig. 8 is a flowchart showing a variation example of the operations of the cordless telephone in Fig. 3.

#### Description of the Preferred Embodiments

15           Referring now to drawings, various preferred embodiments according to the present invention will be described.

          An Embodiment of a cordless telephone according to the present invention will be  
20 described below with reference to the attached drawings. An embodiment of a communication method of the cordless telephone according to the present invention will be described below at the same time.

25           As shown in Figs. 3 and 4, a cordless telephone 2 in this embodiment is provided with a radio section 4, a base band processing section 6,

a control section 8, a registration system storage section 10 (a second storing unit), a base station number storage section 12 (a storing unit), a user interface section 14 containing a plurality of operational keys and the like.

The radio section 4 and the base band processing section 6 constitute a receiving unit 3 according to the present invention.

The radio section 4 receives high frequency signals from an independent system base station and an outdoor public system base station through an antenna 16. The base band processing section 6 performs a demodulation process and the like on the high frequency signals received by the radio section 4 to extract a control signal.

As shown in Fig. 5, the control signal includes a preamble section 18, a synchronous word section 20, a base station number section 22 and an data channel section 24. The respective sections are arrayed in this order.

As shown in Fig. 4, the control section 8 functionally includes a number searching section 26, a number extracting section 28, a storage control section 30, a comparing section 32 and a search control section 34 in accordance with the present invention.

The number searching section 26

periodically searches the control signal received by the receiving unit 3 in a first time interval (a first period) to then judge whether or not a base station number of the independent system is included in the control signal.

The number extracting section 28 periodically extracts a base station number of the outdoor public system from the control signal received by the receiving unit 3.

10       The storage control section 30 stores the base station number of the outdoor public system extracted by the number extracting section 28 in the base station number storage section 12, when the number searching section 26 judges that the  
15       base station number of the independent system is included in the control signal.

      The comparing section 32 compares the base station number extracted by the number extracting section 28 with the base station number stored in  
20       the base station number storage section 12, each time the number extracting section 28 extracts the base station number of the outdoor public system.

      If the number searching section 26 judges  
25       that the base station number of the independent system is not included in the control signal and if the base station number of the outdoor public

system and the base station number stored in the base station number storage section 12 do not coincide with each other as the comparison result of the comparing section 32, the search control  
5 section 34 controls the number searching section 26 to judge whether or not the base station number of the independent system is included in the control signal in a second time interval longer than the first time interval.

10       The operations of the cordless telephone 2 will be described below.

At first, the operation is described if the cordless telephone 2 exists at the location A where the service areas 108, 110 of the  
15 independent system base station 102 and the outdoor public system base station 104 overlap with each other as shown in Fig. 1.

Inside this area, the cordless telephone 2 can receive the control signals from both the  
20 independent system base station 102 and the outdoor public system base station 104. As shown in Fig. 2B, the number searching section 26 periodically searches the control signal received by the receiving unit 3 in the first time  
25 interval (a period T), for example, in a time interval of about 10 seconds to then judge whether or not the base station number of the

independent system is included in the control signal. In this case, the number searching section 26 can receive the control signal 116 to then detect the base station number of the  
5 independent system. Thus, the judged result becomes positive.

By the way, the number searching section 26 extracts the base station number from the control signal 116, and then compares the extracted base  
10 station number with the base station number of the independent system stored in advance in the registration system storage section 10 to judge that the base station number of the independent system is included in the control signal 116 if  
15 the two compared base station numbers coincide with each other.

In addition, the control section 8 has a timer section 8a for taking a time-out for each about 10 seconds. The number searching section 26  
20 judges whether or not the base station number of the independent system is included in the control signal, each time this timer section 8a takes the time-out.

While the number searching section 26  
25 carries out the judgment of the base station number as mentioned above, the number extracting section 28 extracts the base station number of

the outdoor public system from the control signal received by the receiving unit 3 each time the timer section 8a takes the time-out.

The storage control section 30 stores the  
5 base station number of the outdoor public system  
base station 104 extracted by the number  
extracting section 28 in the base station number  
storage section 12, since the judged result of  
the number searching section 26 is positive as  
10 mentioned above.

The operations if the cordless telephone 2  
moves from the point A of Fig. 1 to the point B  
inside the service area 112 will be described  
below with reference to a flowchart in Fig. 6.

15 Also in this case, if the timer section 8a  
takes the time-out (Step S1), the number  
extracting section 28 extracts the base station  
number of the outdoor public system from the  
control signal received by the receiving unit 3.

20 Here, since the cordless telephone 2 exists  
inside the service area 112, the cordless  
telephone 2 can correctly extract the base  
station number of the outdoor public system base  
station 106 (YES at Step S2).

25 Then, the comparing section 32 compares the  
base station number extracted by the number  
extracting section 28 with the base station



number of the outdoor public system stored in the base station number storage section 12 (Step S3).

In this case, since the base station number of the outdoor public system base station 104 is stored in the base station number storage section 12, the compared result becomes inconsistent (NO at Step S3).

At this time, since the cordless telephone 2 exists outside the service area 108, the base station number of the independent system base station 102 is not included in the control signal received by the receiving unit 3. Thus, the number searching section 26 judges that the base station number of the independent system is not included in the control signal.

That is, the number searching section 26 judges that the base station number of the independent system is not included in the control signal, and the base station number of the outdoor public system and the base station number stored in the base station number storage section 12 do not coincide with each other as the comparison result of the comparing section 32. Thus, the search control section 34 controls the number searching section 26 to judge whether or not the base station number of the independent system is included in the control signal in the

second time interval longer than the first time interval.

Actually, the control section 8 has a counter unit 8b. If the result compared by the  
5 comparing section 32 is inconsistent (NO at Step S3), the search control section 34 counts up a count value of this counter unit 8b by 1 (Step S4). Then, in this embodiment, if the count value N of the counter unit 8b exceeds 60 (YES at Step  
10 S5), the number searching section 26 carries out the above-mentioned judging operation (Step S6).

On the other hand, if the value N of the counter unit 8b is equal to or less than 60, the operation returns back to the step S1, and the  
15 number extracting section 28 waits for the time-out of the timer section 8a.

As mentioned above, the number extracting section 28 extracts the base station number of the outdoor public system in the time interval of  
20 about 10 seconds corresponding to the time-out of the timer section 8a (Step S2). Thus, if the cordless telephone 2 continues to exist at the point B, in a time interval of about 600 seconds, namely, about 10 minutes (YES at Step S5), the  
25 number searching section 26 judges whether or not the base station number of the independent system is included in the control signal (Step S6).

Hence, only the waiting operation of the control signal 119 from the outdoor public system base station 106 is carried out in most of the period, as shown in the flowchart of Fig. 7.

5           In this embodiment, if the cordless telephone 2 moves into the service area 112 of the outdoor public system base station 106 far away from the service area 108 of the independent system base station 102, the number searching  
10 section 26 performs the waiting operation to the independent system base station 102 in the time interval of about 10 minutes equal to 60 times the normal time interval. Accordingly, it is possible to reduce the consumption power of the  
15 cordless telephone 2 to thereby make the life of the battery longer.

          In this case, since the cordless telephone 2 exists at the location far away from the independent system base station 102, there is no  
20 possibility that the cordless telephone 2 immediately returns back into the service area of the independent system. Thus, there is no trouble even if the time interval of the waiting operation to the independent system base station  
25 102 is made longer.

          The operations if the cordless telephone 2 moves into the service area 110 from the service

area 108 will be described below.

Also in this case, if the timer section 8a takes the time-out (Step S1), the number extracting section 28 extracts the base station  
5 number of the outdoor public system from the control signal received by the receiving unit 3. Here, since the cordless telephone 2 exists inside the service area 110, the number extracting section 28 can extract the base  
10 station number of the outdoor public system base station 104 (YES at Step S2).

The comparing section 32 compares the base station number extracted by the number extracting section 28 with the base station number of the  
15 outdoor public system stored in the base station number storage section 12 (Step S3). As mentioned above, the base station number of the outdoor public system base station 104 is stored in the base station number storage section 12. Thus, in  
20 this case, the comparison result is consistent, differently from the above-mentioned case (YES at Step S3).

Thus, the search control section 34 does not control the number searching section 26 to  
25 make the period of the waiting operation longer. Then, the number searching section 26 carries out the waiting operation in the time interval of

about 10 seconds, similarly to the case that the cordless telephone 2 exists inside the service area 108 of the independent system (Step S6). At this time, the search control section 34 resets  
5 the counter unit 8b to set 0 as the value N (Step S7).

The number searching section 26 extracts the base station number from the control signal 116, similarly to the actually above-mentioned  
10 case that the cordless telephone 2 exists inside the service area 108 to compare the extracted base station number with the base station number of the independent system stored in advance in the registration system storage section 10 (Step  
15 S8).

In this case, since the comparison result is consistent (YES at Step S8), the number searching section 26 judges that the base station number of the independent system is included in  
20 the control signal 116. Then, the number extracting section 28 extracts the base station number of the outdoor public system from the control signal received by the receiving unit.

Since the judged result of the number  
25 searching section 26 is positive as mentioned above, the storage control section 30 stores the base station number of the outdoor public system

base station 104 extracted by the number  
extracting section 28 at that time, in the base  
station number storage section 12 (Step S9).

After that, the number searching section 26  
5 carries out the waiting operation in a time  
interval of about 10 seconds.

The base station number of the outdoor  
public system base station 104 to be stored in  
the base station number storage section 12 is  
10 detected from the control signal 118 received by  
the receiving unit 3 next to the control signal  
116 in which the number searching section 26  
judges that the base station number of the  
independent system is included.

15 The base station number of the outdoor  
public system base station 104 to be stored in  
the base station number storage section 12 is  
extracted from the control signal 118 received by  
the receiving unit 3 in the same time interval  
20 when the control signal 116 in which the number  
searching section 26 judges that the base station  
number of the independent system is included, is  
received by the receiving unit 3.

As mentioned above, in this embodiment, if  
25 the cordless telephone 2 moves from the service  
area 108 of the independent system base station  
102 into the service area 110 of the outdoor

public system base station 104 adjacent to the independent system base station 102, the waiting operation to the independent system base station 102 is carried out in the same time interval as  
5 the case that the cordless telephone 2 exists inside the service area 108 of the independent system. Thus, even if the cordless telephone 2 immediately returns back into the service area 108 from the service area 110, it is possible to  
10 rapidly make a call through the independent system base station 102.

In addition, if the cordless telephone 2 exists outside the service area 108 and further the cordless telephone 2 does not belong to any  
15 one of the service areas 110, 112, the number extracting section 28 can not extract the base station number of the outdoor public system at the step S2 (NO). Thus, the search control section 34 does not change the above-mentioned  
20 time interval of the waiting operation. Hence, the number searching section 26 carries out the waiting operation to the independent system base station 102 in the time interval of about 10 seconds (Step S6).

25 If a new outdoor public system base station (not shown) is provided near the independent system base station 102, or if the base station

number of the existing outdoor public system base station 104 is changed, it is necessary to update the base station number of the outdoor public system to be stored in the base station number storage section 12. This update operation is done  
5 by the storage control section 30, each time the number searching section 26 judges that the base station number of the independent system is included in the control signal in the time  
10 interval of about 10 seconds, when the cordless telephone 2 exists inside the service area 108.

If the cordless telephone 2 returns back to the service area 108 from the service area 112, immediately after that, the number searching  
15 section 26 carries out the waiting operation in the time interval of about 10 minutes. Also in this case, if the number searching section 26 judges that the base station number of the independent system is included in the control  
20 signal, the storage control section 30 updates the content of the base station number storage section 12.

By the way, in this embodiment, the time interval of the waiting operation to the  
25 independent system is set to be longer, if the cordless telephone 2 moves into the service area 112 of the outdoor public system base station 106



far away from the service area 108 of the independent system. In order to make the consumption power further lower, it is possible to stop the performance of the number searching  
5 section 26, that is, the waiting operation to the independent system base station 102 as shown in Fig. 8.

As mentioned above, in the communication method of the cordless telephone according to the  
10 present invention, if in the number searching step it is judged that the base station number of the independent system is included in the control signal, the base station number of the outdoor public system extracted in the number extracting  
15 step is stored in the storing unit in the storage control step. Then, if in the number searching step it is judged that the base station number of the independent system is not included in the control signal and further the base station  
20 number of the outdoor public system and the base station number stored in the storing unit do not coincide with each other as the comparison result in the comparing step, in the search control step the time interval to judge whether or not the  
25 base station number of the independent system is included in the control signal in the number searching step, is set to the second time

interval longer than the first time interval.

In addition, in the cordless telephone of the present invention, if the number searching section judges that the base station number of the independent system is included in the control  
5 signal, the storage control section stores in the storing unit the base station number of the outdoor public system extracted by the number extracting section. Then, if the number searching  
10 section judges that the base station number of the independent system is not included in the control signal and further the base station number of the outdoor public system and the base station number stored in the storing unit do not  
15 coincide with each other as the comparison result of the comparing unit, the search control section sets the time interval, in which the number searching section judges whether or not the base station number of the independent system is  
20 included in the control signal, to the second time interval longer than the first time interval.

Thus, in the present invention, if the cordless telephone exists at the location far away from the independent system base station,  
25 the time interval to carry out the waiting operation to the independent system is set to be longer. As a result, it is possible to reduce the

consumption power of the cordless telephone. Then,  
since the cordless telephone exists at the  
location far away from the independent system  
base station, there is no possibility that the  
5 cordless telephone immediately returns back into  
the service area of the independent system. Hence,  
even if the time interval of the waiting  
operation is made longer, the trouble is never  
induced.

10

Disclosed is a communication method of a  
cordless telephone that can make a call through  
both an independent system base station and an  
15 outdoor public system base station, and executes  
a receiving step of receiving a control signal  
transmitted from each base station of the  
independent system and the outdoor public system  
and a number searching step of searching  
20 periodically in a first time interval the control  
signal received at the reception step and then  
judging whether or not a base station number of  
the independent system is included in the control  
signal, and includes a storing unit for storing  
25 the base station number of the outdoor public  
system, and further includes:

a number extracting step of periodically

extracting the base station number of the outdoor public system from the control signal received at the reception step;

a storage control step of storing the base station number of the outdoor public system extracted at the number extracting step in the storing unit, if it is judged at the number searching step that the base station number of the independent system is included in the control signal;

a comparing step of comparing the base station number extracted at the number extracting step with the base station number stored in the storing unit, each time the base station number of the outdoor public system is extracted at the number extracting step; and

a search control step of setting a time interval to judge whether or not the base station number of the independent system is included in the control signal at the number searching step, to a second time interval longer than the first time interval, if it is judged at the number searching step that the base station number of the independent system is not included in the control signal and further the base station number of the outdoor public system and the base station number stored in the storing unit do not

coincide with each other in the comparing step.

Disclosed is a cordless telephone that can make a call through both an independent system base station and an outdoor public system base station,  
5 and includes a receiving unit for receiving a control signal transmitted from each base station of the independent system and the outdoor public system and a number searching section for searching periodically in a first time interval  
10 the control signal received by the receiving unit and then judging whether or not a base station number of the independent system is included in the control signal, and further includes:

a storing unit for storing the base station  
15 number of the outdoor public system;

a number extracting unit for periodically extracting the base station number of the outdoor public system from the control signal received by the receiving unit;

20 a storage control unit for storing the base station number of the outdoor public system extracted by the number extracting unit, if the number searching section judges that the base station number of the independent system is  
25 included in the control signal;

a comparing unit for comparing the base station number extracted by the number extracting

unit with the base station number stored in the storing unit, each time the number extracting unit extracts the base station number of the outdoor public system; and

5           the search control unit for controlling the number searching section so as to judge whether or not the base station number of the independent system is included in the control signal in a second time interval longer than the first time  
10 interval, if the number searching section judges that the base station number of the independent system is not included in the control signal and further the base station number of the outdoor public system and the base station number stored  
15 in the storing unit do not coincide with each other as the comparison result of the comparing unit.

          In the communication method of the cordless telephone, if it is judged in the number  
20 searching step that the base station number of the independent system is included in the control signal, the base station number of the outdoor public system extracted in the number extracting step is stored in the storing unit in the storage  
25 control step. Then, if it is judged in the number searching step that the base station number of the independent system is not included in the

control signal and further the base station number of the outdoor public system and the base station number stored in the storing unit do not coincide with each other as the comparison result  
5 of the comparing step, in the search control step a time interval to judge in the number searching step whether or not the base station number of the independent system is included in the control signal, is set to a second time interval longer  
10 than a first time interval.

In the cordless telephone, if the number searching section judges that the base station number of the independent system is included in the control signal, the storage control unit  
15 stores the base station number of the outdoor public system extracted by the number extracting unit in the storing unit. Then, if the number searching section judges that the base station number of the independent system is not included  
20 in the control signal and further the base station number of the outdoor public system and the base station number stored in the storing unit do not coincide with each other as the comparison result of the comparing unit, the  
25 search control unit sets a time interval in which the number searching section judges whether or not the base station number of the independent

system is included in the control signal, to a second time interval longer than a first time interval.

Thus, in the embodiment , if the  
5 cordless telephone exists at the location far away from the independent system base station, the time interval to carry out the waiting operation to the independent system is set to be longer. As a result, it is possible to reduce the  
10 consumption power of the cordless telephone. Then, since the cordless telephone exists at the location far away from the independent system base station, there is no possibility that the cordless telephone immediately returns back into  
15 the service area of the independent system. Hence, even if the time interval of the waiting operation is made longer, the trouble is never induced.

While the present invention has been described in its preferred embodiments, it is to be understood that the words which have been used are words of description rather than limitation and that changes may be made to the invention without departing from its scope as defined by the appended claims.

Each feature disclosed in this specification (which term includes the claims) and/or shown in the drawings may be incorporated in the invention independently of other disclosed and/or illustrated features.



Statements of the objects of the invention relate to the specifically described embodiments, but not necessarily to all embodiments falling within the claims.

The text of the abstract filed herewith is repeated here as part of the specification.

A radio communication method includes (a) providing a mobile station and (b) changing a period. The mobile station can make a call through each of an independent system base station and an outdoor public system base station. The period is a period when a waiting operation to the independent system base station is performed. The period is changed based on a distance between the mobile station and the independent system base station.

C L A I M S:

1. A radio communication method, comprising:
  - (a) providing a mobile terminal apparatus which is adapted to communicate with an independent system base station and an outdoor public system base station; and
  - (b) determining the time intervals at which an attempt to detect a signal from said independent system base station should be made in dependence upon the location of said mobile terminal apparatus relative to the base stations.
2. A radio communication method according to Claim 1, wherein said (b) step comprises making a said attempt only when the mobile terminal apparatus is situated within a given region.
3. A radio communication method according to Claim 2, wherein said given region comprises the receiving regions of said independent system base station and an outdoor public system base station whose receiving region at least partially overlaps with the receiving region of said independent system base station.
4. A radio communication method according to Claim 3, wherein said given region further comprises regions which are not receiving regions of any of said outdoor public system base stations.
5. A radio communication system according to Claim 1, wherein said (b) step comprises determining when a said attempt should be made in dependence upon the distance between said mobile

terminal apparatus and said independent system base station.

6. A radio communication method according to Claim 5, wherein when the distance between said mobile terminal apparatus and said independent system base station is larger than a predetermined value, said time interval is made longer than in the case that said distance is not larger than said predetermined value.

7. A radio communication method according to Claim 1, wherein said location is determined using a receiving signal received by said mobile terminal apparatus from a said outdoor public system base station whose receiving region at least partially overlaps with the receiving region of said independent system base station.

8. A radio communication method according to Claim 7, further comprising providing a plurality of said outdoor public system base stations, wherein

said outdoor public system base station whose receiving region at least partially overlaps with the receiving region of said independent system base station is the outdoor public system base station of said plurality which is closest to said independent system base station.

9. A radio communication method according to any of Claims 1 or 5 to 8, wherein said (b) step includes changing said interval, depending on whether said mobile terminal apparatus is situated within a specific region, wherein said specific region includes

at least a part of the receiving region of said independent system base station and is larger than said part of said receiving region of said independent system base station.

10. A radio communication method according to Claim 9, wherein said specific region includes said receiving region of said independent system base station and the receiving region of a said outdoor public system base station whose receiving region at least partially overlaps with the receiving region of said independent system base station.

11. A radio communication method according to any of Claims 1 or 5 to 10, wherein said (b) step includes:

(c) judging in a first interval whether or not said mobile terminal apparatus is situated within the receiving region of said independent system base station as an independent receiving region, based on a receiving signal received by said mobile terminal apparatus;

(d) detecting, as an unspecific outdoor public system base station, said outdoor public system base station, within whose receiving region said mobile terminal apparatus is situated, regardless of whether said mobile terminal apparatus is situated within said independent receiving region or not;

(e) detecting, as a specific outdoor public system base station, said outdoor public system base station, within whose receiving region said mobile terminal apparatus is situated, when it is judged as a result of said (c) step that said mobile terminal apparatus is situated within said independent receiving

region;

(f) comparing said detected unspecific outdoor public system base station with said detected specific outdoor public system base station;

(g) detecting the distance between said mobile terminal apparatus and said independent system base station based on a result of said (f) step;

(h) judging whether or not said detected distance is larger than a predetermined value; and

(i) performing said (c) step in a second interval longer than said first interval when it is judged as said result of said (c) step that said mobile terminal apparatus is not situated within said independent receiving region and it is judged as a judgement result of said (h) step that said detected distance is larger than said predetermined value.

12. A radio communication method according to Claim 11, wherein said (c) step includes judging that said mobile terminal apparatus is situated within said independent receiving region, when said receiving signal received by said mobile terminal apparatus includes an independent system base station identification signal indicating that said receiving signal is transmitted from said independent system base station,

said (d) step includes detecting said unspecific outdoor public system base station, based on an outdoor public system base station identification signal included in said receiving signal, indicating that said receiving signal is transmitted from said outdoor public system base station, and

said (e) step includes detecting said specific outdoor public system base station, when it is judged that a first such receiving signal includes said independent system base station identification signal as a result of said (c) step, based on said outdoor public system base station identification signal included in a second such receiving signal received by said mobile terminal apparatus immediately after said first receiving signal.

13. A radio communication method according to Claim 12, wherein said (e) step includes detecting said specific outdoor public system base station, based on said outdoor public system base station identification signal included in said receiving signal received together with said independent system base station identification signal by said mobile terminal apparatus.

14. A radio communication method according to Claim 12 or 13, wherein said (e) step includes detecting said specific outdoor public system base station, based on said outdoor public system base station identification signal included in said receiving signal received in a same interval as said interval when said independent system base station identification signal is received.

15. A radio communication method according to any of Claims 11 to 14, wherein said (f) step is performed each time said unspecific outdoor public system base station is detected as a result of said (d) step.

16. A radio communication method according to any of Claims 11 to 15, further comprising

(j) performing said (c) step in said first interval, when it is judged as said result of said (c) step that said mobile terminal apparatus is situated within said independent receiving region or when it is judged as said result of said (h) step that said detected distance is not larger than said predetermined value, and when said (c) step is performed in said second interval.

17. A radio communication method according to any of Claims 1 or 5 to 10, wherein said (b) step includes:

(c) judging in a first interval whether or not said mobile terminal apparatus is situated within the receiving region of said independent system base station as an independent receiving region, based on a receiving signal received by said mobile terminal apparatus;

(d) detecting, as an unspecific outdoor public system base station, said outdoor public system base station, within whose receiving region said mobile terminal apparatus is situated, regardless of whether said mobile terminal apparatus is situated within said independent receiving region or not;

(e) detecting, as a specific outdoor public system base station, said outdoor public system base station, within whose receiving region said mobile terminal apparatus is situated, when it is judged as a result of said (c) step that said mobile terminal apparatus is situated within said independent receiving region;

(f) comparing said detected unspecific outdoor public system base station with said detected specific outdoor public system base station; and

(k) performing said (c) step in a second interval longer than said first interval when it is judged as said result of said (c) step that said mobile terminal apparatus is not situated within said independent receiving region and it is judged as a result of said (f) step that said unspecific outdoor public system base station and said specific outdoor public system base station do not coincide with each other.

18. A radio communication method according to any of Claims 1 to 17, wherein said (b) step includes performing said (b) step in each said interval.

19. A mobile terminal apparatus which is adapted to communicate with an independent system base station and an outdoor public system base station by radio communication, comprising means for determining the time intervals at which an attempt to detect a signal from said independent system base station should be made in dependence upon the location of said mobile terminal apparatus relative to the base stations.

20. A mobile terminal apparatus according to Claim 19, wherein said determining means comprises

- a timer for counting a said time interval and
- a control section for controlling said timer such that said time interval is changed in dependence upon the location of said



mobile terminal apparatus relative to the base stations.

21. A mobile terminal apparatus according to Claim 20, further comprising means for preventing a said attempt from being made.

22. A mobile terminal apparatus according to any of Claims 19 to 21, wherein when the distance between said mobile terminal apparatus and said independent system base station is larger than a predetermined value, said determining means is adapted to make said time interval longer than in the case in which said distance is not larger than said predetermined value.

23. A mobile terminal apparatus according to any of Claims 19 to 22, wherein said determining means is adapted to detect the distance between said mobile terminal apparatus and said independent system base station based on a receiving signal received by said mobile terminal apparatus from a said outdoor public system base station whose receiving region at least partially overlaps with the receiving region of said independent system base station.

24. A mobile terminal apparatus according to any of Claims 19 to 23, wherein said determining means is adapted to change said time interval depending on whether said mobile terminal apparatus is situated within a specific region, wherein said specific region includes at least a part of the receiving region of said independent system base station and is larger than said part of said receiving region of said independent system base station.

25. A mobile terminal apparatus according to any of Claims 19 to 24, wherein said determining means comprises

a judging means for judging as a specific judgement in a first interval whether or not said mobile terminal apparatus is situated within the receiving region of said independent system base station as an independent receiving region, based on a receiving signal received by said mobile terminal apparatus;

a first detecting means for detecting, as an unspecific outdoor public system base station, said outdoor public system base station, within whose receiving region said mobile terminal apparatus is situated, regardless of a result of said specific judgement;

a second detecting means for detecting, as a specific outdoor public system base station, said outdoor public system base station, within whose receiving region said mobile terminal apparatus is situated, when said judging means judges that said mobile terminal apparatus is situated within said independent receiving region as said specific judgement;

a comparing means for comparing said detected unspecific outdoor public system base station with said detected specific outdoor public system base station;

a detecting means for detecting the distance between the mobile terminal apparatus and the independent system base station based on a comparison result by said comparing means;

a distance determining means for determining whether or not said detected distance is larger than a predetermined value; and

a control means for controlling said judging means such that said judging means performs said specific judgement in a second

interval longer than said first interval when said judging means judges that said mobile terminal apparatus is not situated within said independent receiving region and said distance determining means determines that said detected distance is larger than said predetermined value.

26. A mobile terminal apparatus according to Claim 25, wherein said judging means is adapted to judge that said mobile terminal apparatus is situated within said independent receiving region, when said receiving signal received by said mobile terminal apparatus includes an independent system base station identification signal indicating that said receiving signal is transmitted from said independent system base station,

said first detecting means is adapted to detect said unspecific outdoor public system base station, based on an outdoor public system base station identification signal included in said receiving signal, indicating that said receiving signal is transmitted from said outdoor public system base station, and

said second detecting means is adapted to detect said specific outdoor public system base station when said judging means judges that a first receiving signal corresponding to said receiving signal includes said independent system base station identification signal, based on said outdoor public system base station identification signal included in a second receiving signal received by said mobile terminal apparatus immediately after said first receiving signal.

27. A mobile terminal apparatus according to any of Claims 19

to 26, wherein said determining means includes:

a judging means for judging as a specific judgement in a first interval whether or not said mobile terminal apparatus is situated within the receiving region of said independent system base station as an independent receiving region, based on a receiving signal received by said mobile terminal apparatus;

a first detecting means for detecting, as an unspecific outdoor public system base station, said outdoor public system base station within whose receiving region said mobile terminal apparatus is situated, regardless of a result of said specific judgement;

a second detecting means for detecting, as a specific outdoor public system base station, said outdoor public system base station within whose receiving region said mobile terminal apparatus is situated, when said judging means judges that said mobile terminal apparatus is situated within said independent receiving region as said specific judgement;

a comparing means for comparing said detected unspecific outdoor public system base station with said detected specific outdoor public system base station to determine that said detected unspecific outdoor public system base station and said detected specific outdoor public system base station coincide with each other or not; and

a control means for controlling said judging means such that said judging means performs said specific judgement in a second interval longer than said first interval when said judging means judges that said mobile terminal apparatus is not situated within said independent receiving region and said comparing means

determines that said unspecific outdoor public system base station and said specific outdoor public system base station do not coincide with each other.

28. A radio communication system comprising  
a mobile terminal apparatus according to any of Claims 19 to 27;

an independent system base station; and  
an outdoor public system base station.

29. A computer readable recording medium having a program recorded thereon for a process comprising:

(c) judging as a specific judgement in a first interval whether or not a mobile terminal apparatus is situated within the receiving region of an independent system base station as an independent receiving region, based on a receiving signal received by said mobile terminal apparatus;

(d) detecting, as an unspecific outdoor public system base station, an outdoor public system base station, within whose receiving region said mobile terminal apparatus is situated, regardless of a result of said specific judgement;

(e) detecting, as a specific outdoor public system base station, said outdoor public system base station, within whose receiving region said mobile terminal apparatus is situated, when it is judged as said result of said specific judgement that said mobile terminal apparatus is situated within said independent receiving region;

(f) comparing said detected unspecific outdoor public

system base station with said detected specific outdoor public system base station; and

(j) performing said (c) step in a second interval longer than said first interval when it is judged as said result of said specific judgement that said mobile terminal apparatus is not situated within said independent receiving region and it is judged as a result of said (f) step that said unspecific outdoor public system base station and said specific outdoor public system base station do not coincide with each other.

30. A method, a mobile terminal apparatus, a system or a recording medium, substantially as herein described with reference to or as illustrated in Figs. 3 to 8 of the accompanying drawings.



Application No: GB 9912605.4  
Claims searched: all

Examiner: Nigel Hall  
Date of search: 9 November 1999

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.Q): H4L (LDSY, LDSC, LDSHE, LECTP)

Int Cl (Ed.6): H04Q 7/22, 7/24, 7/32, 7/38

Other: Online: WPI, EPODOC, PAJ

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
X, Y, P	GB 2322041 A (NOKIA)	1-3, 7-20, 24, 27-29
Y	GB 2250892 A (PHILIPS)	9-17, 19, 20, 24, 27-29
A, E	GB 2333208 (NEC)	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

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